DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
P. O. Box 103, Downtown Station
MRDOP Omaha, Nebraska 68101

MRD-R 1130-2-5

MRD
Regulation
No. 1130-2-5

1 August 1971

PROJECT OPERATION

Hydro-Power Test Responsibilities

1. Purpose. The purpose of this regulation is to define the responsibilities for various major tests to be conducted for hydroelectric power plants located within the Missouri River Division, the degree of participation by the Omaha and Kansas City Districts, and the test intervals. It is essential that a coordinated approach be made to all operation and maintenance test to insure the integrity of the Federal Power System.

2. Applicability. This regulation is applicable to the Missouri River Division and each District of this Division.

3. Oil Testing and Analysis. The Missouri River Division laboratory will be utilized to perform comprehensive tests periodically on lubricating and insulating oils. The general policy and period of testing is as follows:

a. General.

(1) The MRD laboratory will perform tests on lubricating and insulating oil for the equipment and at the intervals outlined in subsequent paragraphs. As a minimum, however, the following fields screening tests should be performed annually on lubricating and insulating oils by personnel of the Districts.

(a) Visual Inspection - Inspect for suspended solids, water, etc.

(b) Color - Utilizing a color comparator, test for alert value.

(c) Neutralization Number - “Go or No-Go” test for alert value.

(d) Dielectric Strength - Test insulating oil only using ASTM D-1816 standard method.

(2) Submission of oil samples for testing will be arranged by the Districts directly with the MRD laboratory.

This regulation supersedes MRD-R 1130-2-5 dated 11 February 1966

(3) Based on the tests and limiting values for both lubricating and insulating oil tabulated in Appendixes A and B, respectively, the laboratory will indicate on the test forms whether the oil is or is not satisfactory for continued service.

(4) Oil failing to meet the test limits in Appendixes A or B will be replaced, reclaimed or purified as applicable, or retested if contamination during sampling, shipping, or testing is known or suspected. Also field screening test values in excess of alert values, or observations which place the condition of the oil in doubt, will require a laboratory test of the oil.

(5) Occasionally special testing and analysis of oils outside the scope of the MRD laboratory may be required, such as power factor valuated oxidation tests to determine the expected life of the oil prior to inhibiting, the amount of inhibitor to add, what kind of inhibitor should be used, etc. Special tests when required shall be approved by MRD.

b. Lubricating Oil. The oil in the generator and turbine bearings and the governor hydraulic system will be tested once each four years by the MRD laboratory.

c. Insulating Oil. The oil in each main transformer will be tested by the MRD laboratory at five-year intervals. Laboratory testing of circuit breaker oil will be based on the criteria listed in paragraph 3a(4) above.

4. Power Factor (Doble) Testing. The majority of this testing will be supervised and performed by personnel of MRD. Project personnel will prepare the equipment for testing as directed by MRD test personnel and furnish any necessary help. Project and District personnel may at time be requested to perform tests for MRD to determine the deterioration rate, especially if previous tests were marginal, or when only a few tests are required on new or modified equipment. When the test equipment is not being used by MRD, the Projects and Districts may use the Doble equipment for preventative maintenance test on equipment not routinely tested under the MRD test program. Testing of this equipment should be limited to important equipment operating above 2 kV. Power factor testing by MRD personnel will be in accordance with the general policies set forth below:

a. All new equipment with organic insulation that becomes subject to the Doble Test Program will be tested once each year for a period of at least three years.

b. All new equipment with inorganic insulation will be tested once every other year for a period of six years.

c. Initial tests will be made on new equipment prior to energizing.

d. Schedules will usually be prepared in December by MRD for the following year. These schedules will be coordinated with the Reservoir Control Center and the Bureau of Reclamation, or Southwest Power Administration, as applicable.

e. Test interval will be lengthened at the end of a and b, above, or when consistent results are obtained.

f. Tests will be conducted more frequently if deemed necessary.

g. Doble test forms will be filled out in pencil in the field. The completed forms will be hand-carried to MRD for analysis and correction. A Xerox copy of the original will be retained at the project until the analysis and corrections are completed. Corrective action taken, recommendations, and a proposed action schedule will be noted on the original pencil form and on the final copies distributed to the Districts. MRD will make distribution of the completed forms to Doble Engineering Company, the Districts and Projects.

h. The Data Sheet Review Form (DSR 54) will be used for requesting supplies and is to be forwarded directly to the Doble Company who will honor each request made by the power plant superintendent. Each superintendent will be responsible for maintaining an adequate supply of forms at his plant.

i. The cost of transporting the test equipment from one District to another will be borne by the District shipping the equipment. Costs incurred for the equipment rental will be shared by the Districts in proportion to amount of equipment tested.

5. Carrier Current Testing. Annual carrier current performance tests shall be conducted at each power plant under the direct supervision of a MRD representative and in coordination with the applicable government agency or public/private utility maintaining the remote terminal of the carrier circuit. Districts will be responsible for the daily operation and maintenance of their terminals of the carrier current circuits. Routine testing, trouble shooting and maintenance of these circuits will be performed by the Districts. Coordination with the government agency or public/private utility at the remote carrier terminal will normally be on a local basis as required. Problems unresolvable on a local level will be referred by the Districts to MRD for proper action. A permanent log of all "as found", "as left" tests, and adjustments performed while trouble shooting carrier communications failures, and during the routine District and annual MRD carrier tests, shall be kept for review by District and MRD personnel.

6. Governor Testing. Under the provisions of this regulation, the Districts will perform tests on governors; however, the Division will be kept advised as to test procedures and methods to be used and results of the tests. Governor characteristics and response are directly related to the Federal power systems operations, therefore, dissemination of information and coordination of the tests with the marketing agencies will be accomplished by MRD.

7. Generator Testing. Neither high voltage AC nor high voltage DC tests have been adopted for general use in MRD. A continued analysis will be made by MRD of non-destructive electrical testing methods for generators and appropriate tests adopted. Until such type tests are performed, generator windings will be tested by the Districts using low voltage DC insulation resistance (megger) methods on at least a biennial schedule.

8. Relay Testing. The Districts will be responsible for bench testing of protective relays on a minimum biennial schedule. More frequent testing will be performed as required in conjunction with changes in settings, improper operation, or operation under abnormally dusty or dirty conditions. Staged fault test involving line outages must be coordinated through MRD with the Bureau of Reclamation or Southwest Power Administration as applicable. Protective relays at all installations will be subjected to functional checks biennially. Initial test procedures for functional tests of relays on line or bus sections and generators will be submitted to MRD for approval prior to performing the tests.

9. Pressure Vessel Testing. Pressure vessel testing will be performed by the Districts in accordance with the General Safety Requirements Manual, EM 385-1-1 and ASME Code for Unfired Pressure Vessels, with only spot surveillance by MRD. Any proposed changes in scope or procedures will be submitted to MRD for authorization.

10. Miscellaneous Tests. Low voltage insulation resistance measurements (megger tests), potential device ratio and phase angle tests, turbine gate index testing, radio checks and interference tests, resistance and continuity tests, gas analysis, instrument and meter tests, etc., all more or less a part of the routine maintenance program, will be the responsibility of District and Project personnel.

11. Special Tests. At unscheduled intervals special tests involving Division, or District and Project personnel will probably be required. Responsibilities for such tests will be delineated at the time of initial development or instructions.

12. Standard Procedures. Standard test procedures will be used in the maximum extent possible for equipment testing. As necessary, standard procedures will be prepared to insure uniformity in testing, comparison of results, and analysis.

FOR THE DIVISION ENGINEER:

/s/
E. J. FULLER
Colonel, Corps of Engineers
Deputy Division Engineer

2 Appendixes:
App A - Turbine Lubricating Oil
App B - Insulating Oil

DISTRIBUTION:
A
D
E

THIS PAGE CONSTITUTES CHANGE 1 TO MRD-R 1130-2-5, 1 August 1971

MRD-R 1130-2-5
Change 1
1 Aug 71

APPENDIX A

TURBINE LUBRICATING OIL

TEST	ALERT VALUE	LIMITING VALUE
* 1. Neutralization No., max.	0.3 (a)	0.4 (a)
2. Viscosity, Sus @ 100º F	± 5%	± 10%
3. Color, ASTM Scale	1.0 Change from original (a)	2.0 Change from original (a)
4. Interfacial Tension Dynes/cm (unfiltered)	20 minimum (b)	15 minimum (b)
5. Sludge, % by weight, maximum	0.05%	0.1%
6. Water, % by weight, maximum	0.05% (500 p.p.m.)	0.1% (1000 p.p.m.)

Notes: (a) Alert and limiting values listed are for abrupt changes. Higher values may be permissible if applicable over several years of operation.

(b) Increasing oxidation of oil is reflected by decreasing interfacial tension value. Interfacial tension is also lowered by additives such as rust inhibitors.

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* 4. Interfacial Tension Dynes/cm (unfiltered)	15 minimum (b)	10 minimum (b)
5. Sludge, % by weight, maximum	0.05%	0.1%
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